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Warren Spring Laboratory's Dense-Phase System 'Plugs' the Pneumatic Conveyor Gap

Pneumatic conveyors are, of their nature, the most convenient and adaptable systems for transporting 'loose' materials such as grain, rice, sugar, plastics, cement, flour, etc. They have few, if any, moving parts to contact and possibly contaminate the material being moved. They are particularly suited to incorporation in bulk handling and storage systems, applications for which are growing with the increase in the extent of continuous processing. The performance of pneumatic conveyor systems in these applications, particularly where vertical lifting is involved plus the ease of installation and cleanliness, outweighs their greater cost compared with comparable mechanical systems.

However, in spite of the fact that pneumatic conveyors have been on the scene for 50 years or so, there has been surprisingly little development progress and until relatively recently a significant 'performance gap' has existed in the systems available. Pneumatic conveyors are usually classified as dilute-, medium- and dense-phase according to the mass ratio of material to air in the pipeline. Dilute-phase conveyors operate in the range 1-3, medium-phase in the range 3-30 and dense-phase are usually defined as above 25. The classification is rather arbitrary and the ratio is very dependent on the conveying length but it is less so than the volumetric ratio. In this the volume ratio of solid to air is given and since the bulk density of a particulate solid can vary appreciably depending on size and composition it has little meaning unless the bulk density of the material is specified.

Notable shortage

Most commercial conveyors are still lean-phase or medium-phase, capable of handling only free-flowing or easily fluidised materials, needing complicated filtration equipment to disengage the transported material and likely to break up certain materials because of the high transport velocities involved. There has been a notable shortage of the dense-phase systems which will efficiently move particulate materials that will not flow freely because they tend to cohere—cement, flour, powdered plastics, chalk, and many more examples.

There are a number of reasons for this situation. It is very difficult to feed a cohesive material into a pipeline, and even if successfully introduced, it tends to agglomerate and fall to the bottom of the line and block it, especially at bends. Nevertheless, some commercial dense-phase systems have been introduced. But they still only handle cohesive materials that are

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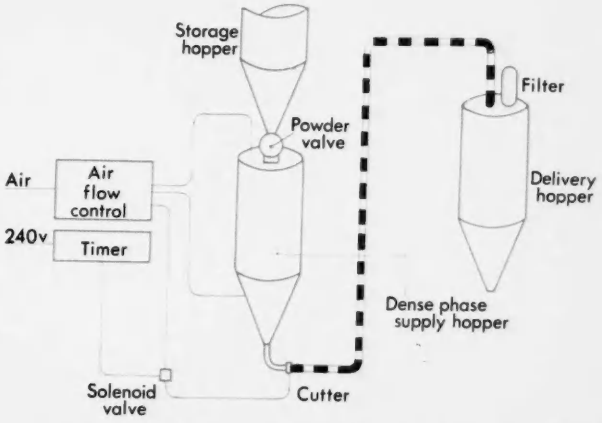

Figure 1. The basic arrangement of the WSL dense-phase pneumatic conveyor.

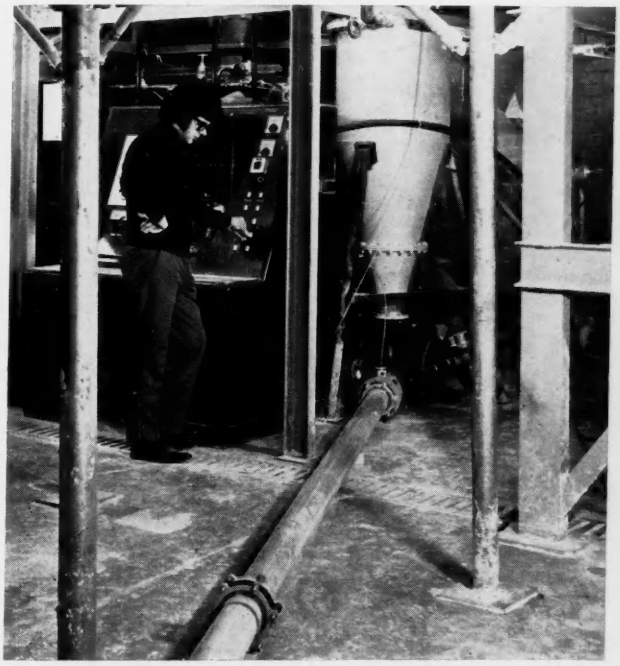

Figure 2. A WSL experimental dense-phase unit conveying electrostatic precipitator dust through a 4-in. diameter pipeline.

fairly easily fluidised, and they need down-the-line air supplies to maintain fluidisation. In addition, moving parts are involved in the devices used to introduce the material into the system.

The situation is being changed by a new British dense-phase pneumatic system of very simple design which can handle a wide range of cohesive materials. It has no moving parts, needs neither down-the-line air supplies for maintaining fluidisation nor complicated material/air separation devices, and is virtually self-cleaning at the end of an operation.

The system, developed by DTI's Warren Spring Laboratory, is available from manufacturers operating under licence from the National Research Development Corporation. Three UK engineering firms have taken out licences and several commercial installations based on the Warren Spring concept are currently in operation—moving cement, chalk and similar powdered materials.

WSL's system is a 'plug-conveyor'—once the material is in the pipeline it is chopped into discrete plugs by air injected into the line at regular time intervals. The introduction of cushions of air in this way reduces the pressure needed to push the material along the pipeline. Warren Spring's successful application of this principle uses the combination of an annular injector to introduce the chopping air into the pipeline and a continuous injection of air into the material in a mass flow hopper. This latter air injection keeps the material 'lively' so that it flows more readily from the hopper under the operating pressure, maintains it in a slightly aerated condition in the pipeline so that it is more easily chopped up and assists the flow of the plugs along the pipe by reducing friction at the pipe walls.

The basic arrangement of the Warren Spring pneumatic conveyor is shown in the accompanying diagram (Fig. 1). WSL took the development to pilot plant stage through various laboratory rigs on which they verified their approach. A first essay with a Perspex hopper, a length of Perspex pipe and powdered chalk showed that the distance between the supply hopper and the air chopper was critical, and that if the plugs of material were of a relatively short length only small operating pressures were needed to move them.

A second laboratory rig which came much closer to being a complete conveyor system, with both supplying and receiving hoppers, showed that the plugs of material moved surprisingly well through small-radius bends in the pipe—in fact the bend helps to compact the plug. This stage of development also demonstrated that the system worked equally well with either the supply hopper pressurised or the receiving hopper under vacuum and the supply hopper open to the atmosphere.

A third experimental rig coped successfully with cement powder, proved the system's vertical lift capabilities, and pointed, to the possibility of flexible pipelines using the WSL method. This experiment also demonstrated the system's self-cleaning facility. As the supply hopper becomes empty the pressure differential through the system drops sharply with a corresponding dramatic increase in linear air velocity. If required, sufficient high-velocity air can be provided to sweep out powder from the pipeline, so that a different material may be passed subsequently without significant contamination.

This small scale plant operation demonstrated that a dense-phase pneumatic conveyor using the principle of dividing a solid powder into plugs would work and with materials like cement would operate at mass ratios of 100: 1 over distances of 200 ft.—which pointed to economical operation.

Greater distances—other materials

The next stage was to determine whether the conveyor could operate over longer distances and handle other materials besides chalk and cement.

Accordingly, the pilot plant system was extended and tests carried out on horizontal and vertical transport using 2 in. and 4 in. bore plastic and glass pipe (Fig. 2) and a wide range of materials. Tests and plant trials were carried out over lengths up to 800 ft. (Fig. 3). Materials investigated were finely divided chalk, cement, pelletised and fluffy carbon black, zinc oxide, lithophone, some PVC powders, cocoa, sprayed dried milk and some dusts from electrostatic precipitators. The exercise enabled an operational theory to be established which could be related to the behaviour of the conveyor and has since been extended to become a design method for a conveyor to carry out a particular duty.

High-speed film studies showed that the plugs of material on the pipeline are very dense, yet are sufficiently dilated to prevent blocking. Solid to air mass ratios are high but decrease as the conveying length is increased. They also vary depending on the bulk density and aeration properties of the material being conveyed.

The mass ratios achieved for a relatively dense material like cement which aerates very well are higher than those given in the following table, while those for a light material like

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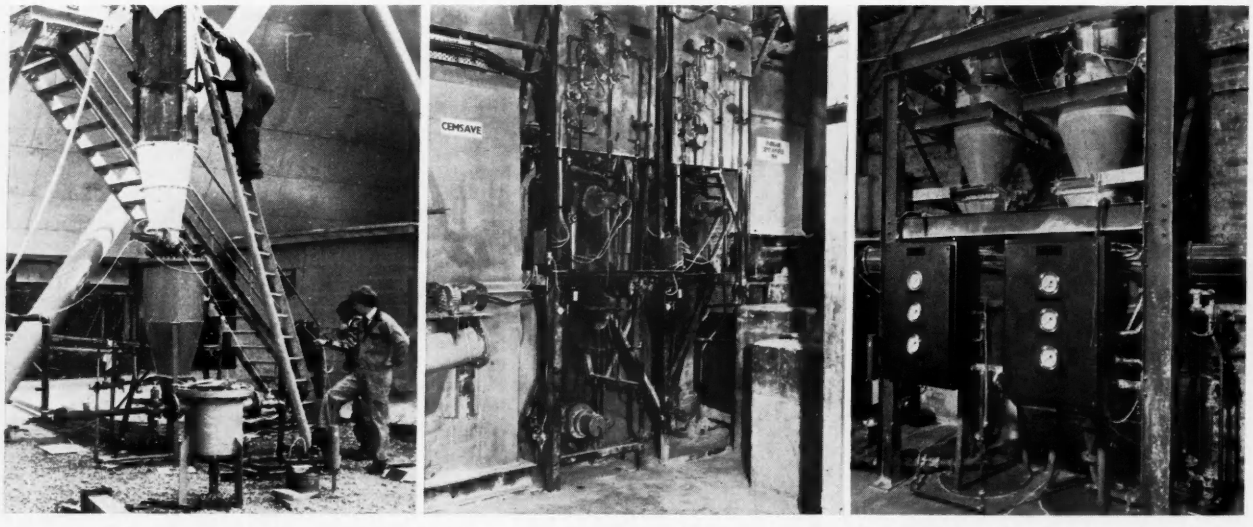


Figures 3 to 5. Left: An experimental dense-phase conveyor undergoing trials at the Northfleet, Kent, works of Associated Portland Cement Manufacturers Ltd. Centre: The first commercial installation—conveying ground basic slag at the Appleby-Frodingham Cement Works of the British Steel Corporation. Right: An installation in a Manchester factory moving Snowcal 7ML.

Buyers and Suppliers Profit from Siraid's Free Advisory Service

by Clary Pickup and Arthur Conway

Siraid Instrumentation & Automation Advisory Centre, Sira Institute

AT first sight an instrument for, say, the monitoring of a chemical process may not seem to be a very significant item of purchase compared with the plant which it helps to control. But instruments and automation equipment are not always simple and cheap. A computer-based system for automatic process control may cost many thousands of pounds. And even when an individual instrument is inexpensive, a complex plant may demand its installation in large numbers. Then the small differences in unit cost can mount up, and when the instrumentation absorbs as much as 10 per cent of the total capital investment the differences mount up significantly.

First-cost is not all, however. There are running and maintenance costs. The productivity of new equipment must be swiftly established and economically sustained if a manufacturing enterprise is to succeed. Clearly it is important to choose the right gear. Clearly, too, it is not enough to choose from a simple buyers' guide when the kinds and variety of gear are changing as rapidly as they are today.

For equipment suppliers it is equally important that their developments become quickly known and understood by the manufacturers who can benefit. Yet, manufacturers will very rarely pay for information about it.

The need was long ago recognised in the UK for an intermediary between the buyers and the suppliers of those producer's goods vaguely known as 'instruments'; and the need is met by Sira Institute, an international research and development establishment specialising in measurement and automation. Sira works impartially for both users and manufacturers of the necessary equipment. To do so it offers all comers an immense range of information, evaluation, innovation and other services, too many even to list here. But in particular Sira offers Siraid, an advisory centre which gives help free (unless special attention is demanded by the inquirer) to anyone who calls upon it by letter or telephone.

Continuously renewed data

The Siraid advisory centre relies on a continuously renewed store of data on currently marketed goods and services. But the centre is much more than an up-to-date library of commercial literature, for between the suppliers' catalogues and the potential purchaser it places a staff of experienced engineers and information scientists, who understand not only their index but their subject matter. They are guides who lead the inquirer over short cuts to what he really wants to know. For example, an engineer who asks where to buy alphameters may, after telephone discussion with a Siraid staffman, be led instead to ask which firm supplies the most appropriate betameter. He has, with expert help, found a better way.

In the last few years Siraid staffmen have answered about 6,000 inquiries a year from intrument users all over the world. From earlier specialisation in scientific and industrial measuring instruments they have moved on to cover virtually all kinds of automatic equipment and accessories. And latterly they have taken on the additional task of providing the where-and-what-to-buy leads which are part of Sira Institute's adhesives consultancy service.

The inquiries received by Siraid are mounting in number as the centre expands its subject field. Now, as Britain prepares for entry into the Common Market, Siraid is planning its operations on a Continental scale.

In the last few years, Siraid staffmen have dealt with some 6,000 inquiries a year from instrument users—20 per cent of them from overseas.

But even while Siraid service has focused on goods purchasable (though not necessarily made) in the UK, no less than 20 per cent of inquiries have come from buyers in other countries.

A few examples serve to show the kinds of export order that have been won by British equipment suppliers as a result of Siraid recommendations. A sale of more than £40,000 worth of industrial, laboratory and educational instruments to a Greek client is one instance. Similar sales to firms in the USA and South Africa have followed on Siraid inquiries. On the advice of Siraid, too, buyers in places as far apart as the Lebanon and Mexico have selected nucleonic equipment, in countries as unlike as Italy and India have chosen optical devices, and in markets as easily reached as Jersey and Portugal have brought electronic equipment. Siraid's value to exporters has been proved in many other overseas markets: such as Argentina, Australia, Brazil, Czechoslovakia, Denmark, Egypt, Eire, France, Germany, Iran, Iraq, Israel, Japan, Kuwait, New Zealand, The Netherlands, Nigeria, Norway, Pakistan, Poland, Saudi Arabia, Singapore, Spain, Sweden, Switzerland and Thailand. Altogether, 16,000 inquiries have been received from other countries since Siraid was set up in 1958.

It is worth noting that non-British references to Siraid are almost bound to be from *bona fide* inquiries intent on buying, and not from mere catalogue-hunters. Siraid does its best to filter out the casual callers anyway, so that sales departments receive only the inquiries they want—the convertible ones.

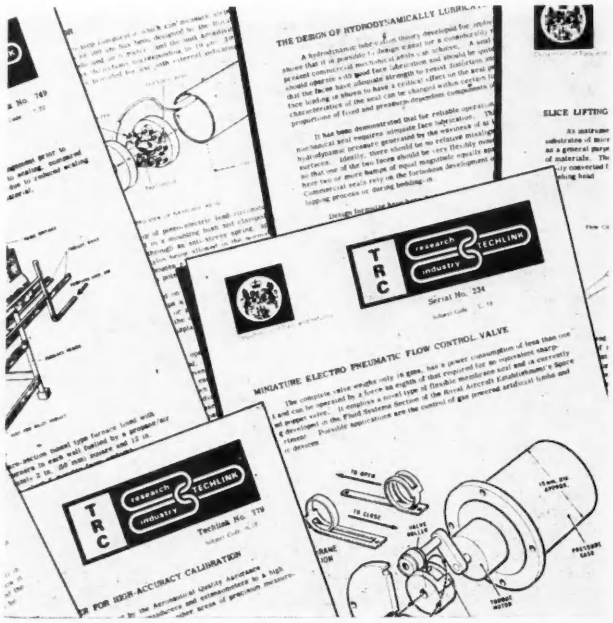
More Information: Suppliers wishing to file their commercial literature at the Siraid advisory centre should contact Mr. W. A. Seatherton. Where-and-what-to-buy inquirers should write or ring Siraid direct. **Siraid, Sira Institute, South Hill, Chislehurst, Kent, BR7 5EH. Tel. 01-467 5555.**

TECHLINK—Industry's Information Link with World Technical Developments

by A. C. Nicholas
Research Division, Department of Trade and Industry

There is a vast amount of work going on in research organisations throughout the UK and in other countries which might hold benefits for industry. But how is industry to know what is going on? Each year, over 40,000 unpublished research reports are lodged with Government R & D information centres—and the vast majority of these are held in DTI's Technology Reports Centre, on which the Techlink information service to industry is based. In this article, the author, who is responsible for the Technology Reports Centre, discusses the philosophy behind Techlink and describes how it works for its industrial subscribers.

'We could have used that idea!' is not Techlink's slogan; but they are words we at Techlink often hear. In fact if we had to choose a motto it would perhaps be 'only connect!' Because our purpose is to garner new knowledge from R & D; sift this for the potentially significant; correlate it with other information which could add to its value; and then bring it to the attention of those who might be able to apply it. We go one step beyond this by always trying to say who can provide additional practical information and follow up advice. We do this because what is important when considering a possible application of new technology is advice in the context of one's own particular needs.



An array of Techlinks. Each takes one topic and summarises its salient points in a single page, using illustrations where necessary.

Efficient transfer

A very real difficulty in securing efficient transfer of new knowledge from research through to profitable innovation is that the problems of doing this are too often under-estimated. In fact, there are no uniquely and generally effective ways of communicating new science and technology. But it does seem to be almost a universal truth that the utilisation of new knowledge can be intensified by purposeful collection, evaluation and dissemination.

Where the arguments start to come is how most efficiently and economically to achieve this desirable state of affairs—what channels must be created between the sources of new knowledge and the potential users?

It turns out in fact that cost and accessibility (with 'cost' taking in more than just financial cost) are usually the chief factors in deciding how much we use a source of information. This is because scientists, engineers and designers seem to follow a 'Law of Least Effort' in relation to the information they use.

More obviously, there is the problem of how to cope with the ever growing volume of information. Less obvious is that the traditional systems for communication in science and technology are better geared to the needs of research than of technical development, design and production. Thus a main output of much developmental research is 'know-how'. This is often applicable to other problems but it is rarely captured efficiently.

Techlink is one attempt to meet these problems. It sets out to serve those in industry concerned with design, applied research and development. Each Techlink deals with a single development or topic and summarises what is significant about it in a one-page digest, illustrated where necessary. Sometimes the information contained in the Techlink is complete in itself. It is always written to give the reader enough detail to decide whether to pursue the idea further and where possible a source of further information is given. With foreign material it is not always possible to refer to the original source but the Techlink staff are often able to suggest on request where further specialised advice might be obtained in the UK.

Another important class of Techlinks report information on 'information'—new state-of-the-art reviews and bibliographies that will be of interest to users, compilations of materials and other technical data and sources of specialised information and advice.

Personal service

Techlink tries to be a personal service. Each item is classified under one or more of 40 subject categories. This enables the user to specify the subjects of interest to him personally. He is then alerted only to ideas and innovations likely to be relevant to his technical interests.

As will be seen, the coverage of Techlink is very wide but the individual series focus quite specifically on topics such as automatic control, fluidics and servo mechanisms. Depending on the intensity of coverage we can offer, the various categories of Techlinks are priced at from £1 to £3 per annum, post free. There is a minimum subscription of £6 a year.

TECHLINK categories

Group A
Subscription £3.00 each

1 Automatic control: fluidics; servo mechanisms
2 Bonding and joining (adhesives, welding, etc.)
3 Design and production techniques and processes
4 Electrical engineering
5 Electronics; circuits and components; communications
6 Forming processes (casting, forging, extrusion, moulding, sintering)
7 Instruments (electrical and electronic)
8 Instruments (optical)
9 Instruments (mechanical)
10 Machining; machine tools
11 Materials testing (including non-destructive testing)
12 Metals (ferrous and non-ferrous)
13 Quality control; inspection

Group B
Subscription £2.00 each

14 Aerodynamics; aeronautical engineering
15 Ceramics; glass; refractory materials
16 Chemical processes
17 Computers; computer programs; data processing
18 Fibres; fibre reinforcement; composite materials
19 Fluid mechanics
20 Heating; ventilation; refrigeration; thermal insulation
21 Management techniques
22 Marine technology; marine engineering
23 Materials handling (packaging, lifting, storage, transportation)
24 Mechanical devices of general application; tools
25 Optics; lasers; photography
26 Plastics and rubber
27 Power sources (engines, turbines, generators, thermal plant, etc.)
28 Protective coatings; corrosion prevention; plating
29 Safety and fire protection
30 Tribology (bearings; lubrication, wear, seals)

Group C
Subscription £1.00 each

31 Building techniques and materials
32 Environmental control; noise reduction, etc.
33 Fuels
34 Industrial health and psychology; ergonomics
35 Isotopes, radiation
36 Mixing techniques
37 Paper; timber; textiles
38 Pumps and compressors; valves
39 Separation techniques (distilling, filtration, drying, cleaning)
40 Vacuum technology

Where the technical interests of a company are broad then all Techlinks can be received for a flat-rate subscription of £25 a year. All subscribers receive the regular indexes to past Techlinks as part of the service. The Techlink Service is at present available only within the UK.

Industrial applications

The service is operated by the Techlink Unit and is based on the DTI Technology Reports Centre at Orpington in Kent. This enables the Unit to exploit the 40,000 unpublished reports which are lodged each year with Government R & D information centres. The staff of Techlink screen this material, looking particularly for those items which should have useful industrial applications. From these they extract the essence, check back to round out the story, evaluate, categorise, summarise.

Even more important are the ideas and developments which are identified for Techlink and contributed directly by Government research establishments such as Harwell; by the National Research Development Corporation; by industry's own research associations; and by British universities and colleges. Many of these Techlinks report 'know-how' which might not otherwise become generally available so quickly. Techlink also draws heavily on the results of overseas R & D.

When selecting topics for Techlink we try particularly to cover developments which might not reach subscribers through other channels. A recent survey of users of Techlink in its experimental phase showed that 85 per cent of respondents—and there was an encouraging 70 per cent response to our inquiry—felt we were largely achieving this object; 40 per cent were able to tell us that they had been able to put information received through Techlink to practical use; and almost 50 per cent had been prompted to make contact with the sources suggested by Techlink for further information.

Typical problems

The following are illustrative of the kinds of problems for which Techlink can offer solutions:

★ How, using low-cost pneumatics, can closely controlled torques be applied in production line conditions?

★ Where to go for a deep review of the present state-of-the-art of glass fibre reinforced plastics?

★ How can the characteristics of visual transparency and ultra-violet light screening be combined in organic surface coatings?

★ Where to go for authoritative and comprehensive advice on how to use lasers safely?

★ How can the torsional rigidity of shafts and similar components be measured without elaborate equipment and without introducing confusing flexural stresses?

★ What has been the experience of other industries in changing over to SI Units?

★ How, in order to check-out electronic equipment, can DC power-supply transients be accurately simulated of either polarity and of controlled energy, rise time and duration?

For further information: The Techlink Unit, Technology Reports Centre, Department of Trade and Industry, Orpington, Kent, BR5 3RF. Tel. Orpington 32111, Ext. 129.

sprayed dried milk are lower. The combination of high mass ratios and the method of operation by which fine materials stay relatively agglomerated in a plug allows filtration equipment at the discharge end to be cut to a minimum. Materials move at low velocities, between 7 and 37 ft./sec.. which means that pipe wear and particle breakdown is low. A further contribution to low particle breakdown comes from the compact nature of the plugs themselves which reduces the relative motion of individual particles.

Mass ratios obtained in the WSL Dense-Phase Conveyor using finely ground chalk

Length including bends ft	Average mass ratio solid to air	Approximate operating pressure, psig
50	200	8
200	70	17
400	35	23
600	30	27
800	25	30

The tests on the vacuum system showed that it was useful for deaerating material and transporting it short distances. For instance, under 22 in. of mercury vacuum a finely divided chalk (Snowcal 2 ML) was transported 70 ft. including a vertical lift of 25 ft. at a rate of 1½ tons/hr. in a 2 in. line. This compares with a distance of 600 ft. in a horizontal 2 in. line at rates over 4 tons/hr. using 26 psig pressure. However the material at the discharge end of the vacuum system was considerably deaerated and reduced in volume.

The Warren Spring Laboratory's dense-phase system has now gone commercial. NRDC has granted licences to: Doulton Industrial Products Ltd., Stb Engineering Ltd. and Sturtevant Engineering Co. Ltd. Systems have been installed by the licensees that are operating on materials such as cement, ground basic slag, some PVC powders, finely ground chalk, etc.

For more information contact:

Doulton Industrial Products Ltd.
Aerox Filtration Division,
Filleybrooks,
Stone,
Staffordshire. Stone 3241

Stb Engineering Ltd.
Fromehall Works,
Stroud,
Gloucester. Stroud 5879

Sturtevant Engineering Co. Ltd.
Hamlyn House,
Highgate Hill,
London N19 5PP. 01-272 0233.

The Director,
Warren Spring Laboratory,
P.O. Box 20,
Gunnels Wood Road,
Stevenage,
Herts SG1 2BX. Stevenage 3388.

Mr. S. Pridham
National Research Development Corporation,
Kingsgate House,
66 Victoria Street,
London SW1E 6SL. 01-828 3400.

news

Government laboratories re-organised

FROM January 1, 1972, the Building Research Station, the Fire Research Station and the Forest Products Research Station Laboratory have been amalgamated into a single organisation to be known as the Building Research Establishment. From the same date the Road Research Laboratory was renamed the Transport and Road Research Laboratory.

Announcing these decisions on December 21, 1971, in a written reply to a Parliamentary Question, Mr. Peter Walker, Secretary of State for the Environment, said:

'After the necessary consultations I have decided, in the interests of increased efficiency and greater flexibility in carrying out the Department's research programme, to amalgamate the Building Research Station, the Fire Research Station and the Forest Products Research Laboratory into a single organisation to be known as the Building Research Establishment.

'The Fire Research Station will retain its present name and will be a department of the Building Research Establishment. The existing joint arrangements for collaboration between HM Government and the Insurance Companies will be maintained for the time being. Discussions are however taking place with the Insurance Companies in regard to future responsibilities for certain work at the Station, eg routine testing. The Forest Products Research Laboratory will become the Princes Risborough Laboratory and will also be a department of the Building Research Establishment.

'It is envisaged that the activities of the Stations will largely embrace the fields covered in the past. Both will remain identifiable working units headed, as at present, by Deputy Chief Scientific Officers, who will become Assistant Directors of the Building Research Establishment. The present Director of the Building Research Station (Mr. J. B. Dick) will become Director of the Building Research Establishment.

'I have also decided that from January 1 the Road Research Laboratory should be known as the Transport and Road Research Laboratory to reflect its wider interests and activities.'

The changes follow a review of the Department's research organisations including the programmes of the research establishments under the Departments' control.

Building Research Establishment. Much of the work of the three stations referred to in the Secretary of State's reply is essentially in the same field and deals with materials and structures. The Stations also provide technical and scientific support for regulations concerned with building. The new arrangements whereby the Stations' programmes are viewed and administered as one should lead to a more effective and economic research organisation. Among the interested parties consulted before the new arrangements were agreed were the Fire Offices' Committee who, with the Independent Companies, are responsible jointly with the Department for the running of the Fire Research Station through the joint Fire Research Organisation, and the Home Office.

Transport and Road Research Laboratory. The Road Research Laboratory was set up in 1933 under the Department of Scientific and Industrial Research to study road making and materials. The scope of this work has widened considerably over the years and the change of title now announced reflects the additional interests of the Laboratory.

Activation analysis course

THE Analytical Sciences Division of Harwell is again providing a short course on various aspects of the techniques and applications of activation analysis, at the Post-Graduate Education Centre, Harwell, on March 15, 16 and 17.

Activation analysis can solve many of today's more difficult analytical problems. It is a method of chemical analysis based on the identification and measurement of radioactivity induced in a sample by nuclear irradiation using neutrons, charged particles, or energetic gamma photons.

An introduction to nuclear reactions will be followed by lectures and demonstrations which will include the techniques of thermal neutron, fast neutron, charged particle, and gamma photon activation analysis. The application of these techniques to trace element measurements and identification, surface studies, etc., in both the academic and industrial field, including on-line analysis will be demonstrated.

More information: Analytical R and D Unit, AERE, Harwell, Didcot, Berkshire.

More time for consultation on R & D Green Paper

THE Government have decided to extend by one month the time for consultations on the proposals contained in the Green Paper, *A Framework for Government Research and Development*, published on November 24 (see *New Technology*, December, 1971).

In a written answer to a Parliamentary question on December 21, 1971, Mrs. Margaret Thatcher, Secretary of State for Education and Science, said:

'I understand that because of unexpectedly heavy demand copies of *Cmnd 4814* were not available between November 25 and December 3, but are now obtainable from Her Majesty's

Stationery Office. In response to views which have been expressed about the time-table of consultations, particularly in view of the Christmas period, the Government have decided to extend by one month the dates set out in the Green Paper. The purpose of this is to allow time, especially for discussions following the submission of comments.'

The revised programme allows for the Government to complete discussions with the Royal Societies, the Council for Scientific Policy, the Research Councils and the appropriate Staff Associations by the end of March 1972, and to publish their final conclusions in a White Paper as soon as possible thereafter.

Timber publications

The Sterilisation of Exported Packaging Timber (Paper No. 49), by M. G. White was written against the background of collaborative investigations by the Pest Infestation Control Laboratory and the Princes Risborough Laboratory to establish the most economical way of satisfying Australian quarantine regulations concerning imported timbers. It outlines the aims of timber-quarantine measures, and shows where these can be met by inspection and where treatment is obligatory. Fumigation with methyl bromide offers substantial savings over alternative methods of sterilisation or preservation, and the paper compares the ways in which fumigation can be undertaken, and gives examples of the necessary procedures and documentation.

Band and Circular Sawmills for Softwoods (Bulletin No. 55), by D. E. Montague (the outcome of a study of sawmilling practice at home and abroad)—gives data and recommendations on sawmill machines, layouts, operation, productivity and economic assessment.

The Prevention of blue-stain in packaged Baltic Redwood (Paper No. 47), reports an experiment to assess the effectiveness of anti-stain treatments and of wrappings in the prevention of staining in commercially seasoned timber. It was prompted by the incidence of degrade caused by blue-stain in packaged redwood imported from Finland. It concludes that packaged timber treated, dried and with intact wrappers can be stored outside for one year in Finland and six months in the UK with an acceptable level of protection. The work was carried out by J. G. Savory and J. Nash-Wortham, of the Princes Risborough Laboratory, and K. Brommels, of Kymmene Aktiebolag, Finnish sawmillers and exporters, together with J. H. Leigh of Price and Pierce Ltd.

The Growth and Structure of Wood (Bulletin No. 56), by B. J. Rendle, provides an introduction to technical literature on timber and is recommended for all students concerned academically or practically with wood and its uses.

The papers are available free from the Princes Risborough Laboratory of the Building Research Establishment, Princes Risborough, Aylesbury, Bucks. (Tel: Princes Risborough 3101), and the bulletins from HMSO at 42p (No. 56) and 80p (No. 55).

CAD in surface design . . .

THE Department of Trade and Industry's Computer Aided Design Centre and the IPC Publication *Computer Aided Design* are co-operating on a seminar on CAD in surface design. To be held at Churchill College, Cambridge, from March 15-17, it will deal with the application of computer techniques for three-dimensional engineering design and manufacture (first developed in the aircraft and shipbuilding industries) to the fields of general engineering, dies and moulds. More information from: CAD Centre, Madingley Road, Cambridge (Tel: 0223 63125, Mr. F. R. Carpenter) or *Computer Aided Design*, Dorset House, Stamford Street, London SE1.

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Or by subscribing to the 12 issues of *Trade and Industry* per year which contain *New Technology* at £1.75 (including postage).

Subscriptions to: HMSO, PO Box 569, London SE1.

Reprints of *New Technology* are available (at 5p per copy) from: New Technology, Room 437, Department of Trade and Industry, 1 Victoria Street, London SW1H 0ET.

. . . electrical engineering

AN Institution of Electrical Engineers conference on Computer Aided Design (April 24-28) will cover all aspects of engineer-oriented computer programs intended as an aid to the design process in the spheres of electrical engineering, from power to circuit applications and mechanical engineering for both machinery and structures. Electronic, electrical, mechanical and civil engineers, together with applied mathematicians and programmers, will discuss problems relevant to computer-aided design in engineering and topics such as design automation, hardware, software and application programmes.

Organised by the IEE and the Electronic Engineering Association, the conference is being held at Southampton University. Provisional programmes and registration forms are now available from: The Manager, IEE Conference Department, Savoy Place, London WC2R 0BL.

. . . and building design

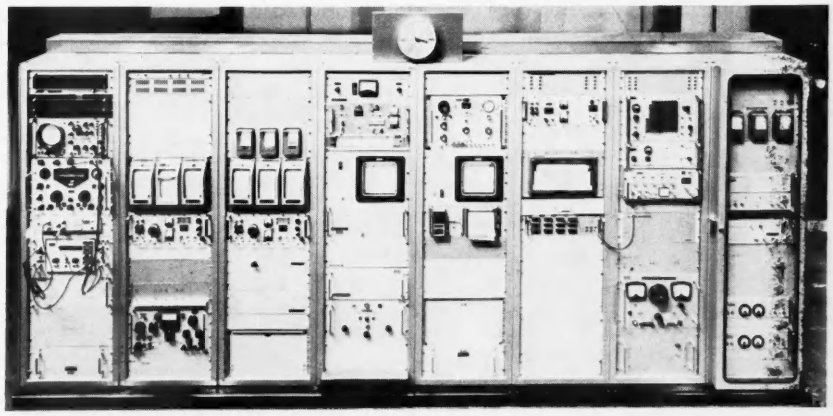
A fourth major computer-aided design system for buildings is to be developed at the DTI's Computer-Aided Design Centre at Cambridge, A consortium of south England local authorities which has developed the building component system known as METHOD has commissioned the Royal College of Art's industrial design research unit to develop a number of evaluative computer programs for METHOD buildings. Benefits are likely to result in automatic production of drawings and schedules. The first three CAD systems for buildings involve integrated systems for hospitals (Department of Health and Social Security), for post-office engineering depots (Department of the Environment), and for the Oxford method of building (Oxford Regional Hospital Board).

Engineering metrication progress

VERY few firms engaged in metric production have actually met the problems they were expecting, reports the Metrication Board in the third issue of its quarterly bulletin *Going Metric*. During 1971 there was a significant rise in the number of firms producing in metric. Firms manufacturing items such as sized cutting tools and fasteners (both threaded and unthreaded) have made the most progress. These are the preliminary findings of a survey commissioned by the Board, details of which will be published in its third annual report. Free copies of *Going Metric* from : Information Office J, Metrication Board, 22 Kingsway, London WC2B 6LE.

Noise and vibration conference

A THREE-DAY conference for industrialists on noise and vibration organised by the Society of Environmental Engineers in conjunction with the Institution of Electronic and Radio Engineers, the University of Bath and the University of Wales Institute of Science and Technology is to be held at Bath University from April 10 to 12. The 14 papers presented will seek to increase awareness of noise and vibration problems and of means of assessment and solution among engineers, architects, consultants and others concerned with these problems in industry. Developments in materials, environmental vibration testing techniques and their availability to firms and legal aspects of the subject will be reviewed. An exhibition will be held as part of the conference. Full details are available from the Society of Environmental



On January 1, 1972, the world replaced time-keeping based on astronomical observation with a more accurate system which relies on atomic transition frequencies. An internationally agreed atomic time-scale is now made available from the International Time Bureau in Paris and is the basis for all time-signal broadcasts. In the UK the change affects Big Ben, the Post Office speaking clock, and radio and TV time signals broadcasts. It will also facilitate world-wide navigation, satellite tracking, radio astronomy and high-speed communications—all of which rely on precise time synchronisation. The atomic clock, from which the international time scale is derived, was first developed at the National Physical Laboratory, Teddington. This picture shows NPL's atomic clock installation which generates the Laboratory atomic time scale and relates it, by means of precise radio signals, to atomic clocks in other countries, so contributing to the co-ordinated international time system.

Engineers, 68a Wigmore Street, London W1H 9DL.

Crash course on standards

WHEN it comes to awareness of the practical advantages of participation in standards work, says the British Standards Institute, many firms are left standing. To bridge the information gap the BSI is offering a one-day crash course on March 10 in London.

The course will include an introduction to BSI and its role as the official UK standards body; the way in which standards are initiated and drawn up by BSI hand-in-hand with industry; international work in conjunction with bodies such as the International Organisation for Standardisation; internal company standards; compilation of a company standards manual; suitable reference systems for designating specifications; and other information on everyday standards department practice.

Fee for the course, which qualifies for the Engineering Industry Training Board grants, is £8.

Inquiries to the Secretary, Standards Associates Sections, BSI, 2 Park Street, London W1A 2BS.

Surface coatings benefits

A ONE-DAY seminar, which aims to show the cost and performance benefits which can be achieved through coatings applied by welding and spraying systems, is to be held at Kenilworth on February 29. Organisers are the Welding Institute, the National Centre of Tribology and the DTI West Midlands Region. An exhibition is being mounted as an integral part of the seminar, and delegates will be able to discuss their problems with major suppliers. A special film has been produced to introduce the various surfacing processes available to industry, and a seminar handbook will contain the critical information presented during the day, together with a buyers' guide. Details from: The Welding Institute, Abington Hall, Abington, Cambridge CB1 6AL.

Break-bulk cargo study

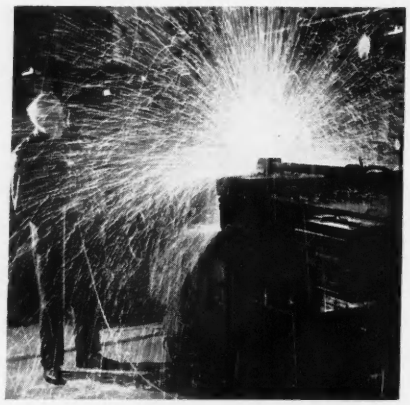
THE Economic Development Committee for the Movement of Exports has commissioned the National Materials Handling Centre of the Cranfield Institute of Technology to study modern methods of preparing break-bulk cargo for easy and rapid handling through the ports. The report of the study, which will be published, will urge increased use of modern practices by exporters and all those involved in overseas trade.

Fire prevention education for managers

To assist management improve fire safety in factories, the Fire Protection Association is running a five-day residential course in March. Called *Fire Prevention for Management*, the course aims to educate senior personnel in the concept of identifying, evaluating and managing fire risks in factories. It is designed for managers and works staff concerned with production, plant, stores, maintenance and buildings, as well as fire surveyors and senior works fire and safety officers.

Illustrated talks and discussions will cover the nature and causes of fire, fire hazards, controlling fire spread and planning a firm's fire protection. Practical application is stressed and course members will practise their newly-learnt theory in small groups, assigned to solving imaginary but realistic factory risk situations.

Fire prevention for management is to be held at Elvetham Hall, Hartley Wintney, Hampshire on March 19-24. Fee for course, including full accommodation, is £69. Further details and booking forms are available from the Secretary, Fire Protection Association, Aldermary House, Queen Street, London EC4N 1TJ.



Live flash-welding demonstrations on boiler tubes were part of a Welding Institute research seminar in December, when for the first time the Institute released confidential technological information to non-members. The information resulted from a £25,000 Welding Institute group-member project aimed at evolving a procedure for flash-welding boiler tubes to a consistently high quality. The procedure efficiently determines optimum welding conditions by stipulating the order and manner in which the variables of welding should be adjusted during machine set-up. A standard weld-bend test provides a cheap, rapid and reproducible indication of weld quality. Non-members, who paid an attendance fee of one per cent of the project cost, came from Britain, West Germany, Sweden, Holland and Austria. More information: The Research Manager, The Welding Institute, Abington Hall, Abington, Cambridge CB1 6AL.

German Industrial Guidelines in English

A PUBLISHING programme has begun to make available in English all the VDI Richtlinien—the German Industrial Guidelines and codes of practice drawn up by the specialist committees of the Association of German Engineers (VDI). Three subject areas have been dealt with initially by the publishers, Peter Peregrinus Ltd., PO Box 8, Southgate House, Stevenage, Herts. They are temperature, pressure and flow measurement; numerical control of machine tools; and vibration technology. The translations are available at £12, £4.50 and £2.75, respectively, including a free three-year updating service.

Publication of translations of further sections of the Richtlinien will follow. Subject areas will include production processes and equipment, power engineering, precision engineering, materials handling, heating, plastics, ventilation, air pollution control, design, noise abatement, food technology and dust control. A below-cost translation of these Guidelines is offered by the publisher prior to their publication in English.

To explain the significance of the Guidelines, and of their publication in English, the publishers are holding seminars in London (February 10), Manchester (February 11) and other centres.

German-language originals of the VDI Richtlinien continue to be available through the loan service operated by the Department of Trade and Industry.

Wire industry metrication

THE Institute of Iron and Steel Wire Manufacturers has prepared a leaflet to coincide with the changeover to metric weights and measures in the steel wire industry on January 1, 1972. Entitled *Metrication in the Steel Wire Industry*, it lists British Standards in metric and Institute publications providing design data on the use of steel wire. Copies available on request from: Institute of Iron and Steel Wire Manufacturers, Rodwell Tower, Piccadilly, Manchester M1 2HX.

Monthly machine tool information

THE *Library Bulletin* of the Machine Tool Industry Research Station is to be made generally available to non-members. The *Bulletin* is a monthly current-awareness survey of the major contents of some 160 journals as well as particulars of relevant new books, translations, conference proceedings, etc. The information services are now available to any subscriber to the MTIRA *Library Bulletin*. Details from: The Information Officer, MTIRA, Hulley Road, Macclesfield, Cheshire SK10 2NE. Tel: 0625-25421/26189.

Harwell develops system for scheduling bulk-cargo fleets

Believed to be the only commercially available scheduling technique in the world to enable the earning power of a bulk-cargo fleet to be fully realised, Harwell's new system (which involves use of a new computer program) has been in daily commercial use by a UK shipping company for more than a year, and has substantially increased fleet profitability under both strong and weak market conditions. Its value has also been demonstrated in trials with other operators, both in the UK and in Scandinavia. Planning and scheduling are normally achieved directly from the fleet operator's office by one member of the staff, who communicates with the computer by telex or teletype terminal. Considerable improvements in efficiency can be obtained even with fleets of less than 10 ships: for example, with a fleet of only eight ships and a total of 400 ship-days, the schedule produced by Harwell's program was eight days shorter than that produced by manual techniques. More information: Dr. I. M. Cheshire, Computer Optimisation Group, AERE, Harwell, Didcot, Berks. Tel: Abingdon 4141, Ext 2080.

More information: Where possible, items in *New Technology* indicate the best sources of further information. Readers are advised also to seek information on matters relating to *New Technology* from the following DTI regional offices: Edinburgh 031-225 1822; Cardiff 62131; Newcastle upon Tyne 27575; Manchester, 061-832 9111; Leeds 38232; Nottingham 46121; Birmingham, 021-643 8221; Bristol 21071; London and South East, 01-684 9781; Eastern, 01-828 4355. In Northern Ireland, information is given by the Dept. of Industrial and Forensic Science, Belfast 21722.

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